

Attachment B

Ground Water Protection Analysis and Documentation Process

It is the responsibility of the BLM to ensure that usable ground water zones, including Sole Source Aquifers (SSAs) and Drinking Water Source Protection Zones (DWSPZs), are protected through review and analysis at the filing of a notice of staking (NOS) or application for permit to drill (APD), and during subsequent drilling and completion operations. The attached worksheets are to be used to document the adequacy of the applicant's submitted geologic and hydrologic data (Attachment C) and proposed casing-cement program adequacy (Attachment D). These worksheets must include, at a minimum, the requirements found in Onshore Order No. 1, Section III, D., 3. Drilling Plan, and D., 4. Surface Use Plan of Operations, and contain the necessary mitigation measures, Conditions of Approval (COAs), references and other documentation. The regulations and guidance summarized in Attachment A outline the tasks that need to be completed.

➤ **NOS Notification**

- Upon notification of staking, the geologist and/or hydrologist must review the proposed well location proximal to a SSA or DWSPZ and analyze the potential for impact. The spatial GIS data, referenced below in the hydrologic review section, should be reviewed for well placement. All usable ground water zones will be evaluated and protected at the APD stage.

➤ **APD Review**

- Geologic and Hydrologic Reviews – Upon submission of an APD, the field office hydrologist and/or geologist will review the applicable portions of the Drilling Plan (DP) and Surface Use Plan of Operations (SUPO) to verify that the operator's anticipated formation depths/elevations and predicted mineral zone determinations correspond with BLM's geologic/hydrogeologic interpretations. This review will determine depth intervals of all known water-bearing zones with water quality ≤ 10,000 mg/L total dissolved solids (TDS). Identification of these zones will be independently assessed using available publications and data sources including, but not limited to:

United States Geological Survey (USGS) - such as Technical Publication 92 for the Uinta Basin, Circular 1236 Water Quality in the Great Salt Lake Basins, and Scientific Investigations Report 2007-5192;

Utah Geological Survey (UGS)

<http://geology.utah.gov/utahgeo/water/index.htm#other> and
<http://geology.utah.gov/utahgeo/energy/oilgas/index.htm>

Utah Division of Water Rights (UDWR) <http://utstnrwrt6.waterrights.utah.gov/cgi-bin/wrplat.exe?Startup>

UDEQ's ground water quality protection program within the Division of Water Quality (DWQ) <http://www.waterquality.utah.gov/GroundWater/index.htm>

The DWQ Division of Drinking Water (DDW) website posts a user guide for ground water source protection, which should be used when developing mitigation measures with the Public Water System (PWS) manager and the oil and gas operator. http://www.drinkingwater.utah.gov/source_protection_intro.htm

Utah Division of Oil, Gas and Mining (UDOGM) Environmental Handbook with guidance for determining surface casing setting depths and describing water-bearing zones requiring protection (p.30). https://fs.ogm.utah.gov/pub/Oil&Gas/Publications/Handbooks/env_handbook.pdf

GIS layers and the DWD DWSPZs.mxd project file, depict the DWSPZs spatial locations and are located at:
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Review information and well logs from previously-drilled adjacent wells, including private, livestock water and other wells. Use the Saturation Method Apparent Water Resistivity (R_{wa}) Method for calculating apparent resistivity of formation water as calculated from electric logs. Geologic logs and construction diagrams from all wells, including private water wells, (see SUPO, Location of Existing Wells) within one mile of the proposed APD location will be reviewed, with depths and water production zones converted to elevation, to assess potential impact from the proposed oil and gas well. If an APD is proposed to be sited in a DWSPZ, all wells within the zone should be reviewed.

The Geologic and Hydrologic APD Review form (Attachment C) must be used to document review findings and recommendations and subsequently placed in the well file. Questions on form completion or GIS project files should be addressed to Mike McKinley, Environmental Scientist, at (801) 539-4046.

- *Engineering Review* - The petroleum engineer (PE) reviews the DP and information from the BLM geologic/hydrologic APD review worksheet to determine if the proposed casing and cementing program is adequate to protect and/or isolate usable water, oil, gas, or prospectively valuable deposits of other minerals as required by Onshore Oil and Gas Order No. 1 (see Section III, D, 3, b). The surface casing should be set at a minimum depth of 100 feet below the base of any aquifer used for a public water supply, within a DWSPZ or SSA, and any other aquifer containing useable ground water. Alternatively, if the operator brings cement for the production string and/or intermediate string into the surface casing and it is deemed properly placed, usable ground water protection will have effectively been accomplished following cement bond log review and BLM's adequacy determination.

The complete engineering review will be documented on the APD Engineering Evaluation Worksheet (Attachment D), a copy of which must be placed in the case file. All applicable portions must be completed (refer to the instruction tab for

details). Field offices should adjust the form(s) as appropriate to resolve specific issues. The Engineering Evaluation Worksheet is intended to be a living document. Future enhancements will be incorporated when developed. Questions on form completion should be addressed to Al McKee at (801) 539-4045.

- Natural Resource Specialist (NRS) Surface Review – The NRS reviews the operator's submitted SUPO for surface and/or usable ground water resource protection adequacy, including potential impacts to shallow ground water from reserve pit design and construction. If during the geologic and hydrogeologic review process ground water occurrence and/or depth cannot be determined from the aforementioned reference sites, a hydrologic assessment of the proposed well pad and pit location will be required. Additional pit siting and lining evaluation criteria can be found in UDOGM's Environmental Handbook (pp. 21-26, see link above). When shallow ground water is encountered during construction of the pad or reserve pit, the operator will be required to use a semi-closed loop system. A COA stating that *"if ground water is encountered during construction of the pad or reserve pit, the operator must immediately notify the authorized officer (AO), and BLM will require the use of a semi-closed loop system (no reserve pit) for drilling fluids"* will be attached to all APDs. A semi-closed loop system for drilling fluids must be used if a well is proposed to be drilled in a SSA and may be required in a DWSPZ if deemed necessary by the AO. In all cases, the reserve pit will be inspected after construction and prior to drilling to verify the absence of porous soils/fractured bedrock or integrity of the liner. Utilize Gold Book guidance, references in Attachment A and the links above to complete a comprehensive review.

➤ **Drilling and Completion**

- The petroleum engineering technician (PET) inspects the well site during drilling and completion to ensure compliance. For any well drilled within a DWSPZ or SSA, a log should be run before cementing of the surface casing. All wells drilled within a DWSPZ or SSA will be rated high for inspection strategy purposes and shall, at a minimum, be inspected during surface casing and cementing operations to ensure cement is properly placed sufficient to protect usable ground water zones, either through the primary operation or appropriate remedial cementing. If zonal isolation is in question, cement evaluation logs/tools and/or monitoring of casing annular pressure, e.g. Bradenhead tests, should be employed to validate ground water protection.
- For wells drilled within a DWSPZ, the PE, geologist and/or hydrologist will review the geologic log for usable water-bearing zones contacted during drilling, losses of circulation, etc. If available, the geophysical logs should be reviewed for occurrence of usable water and the cement bond log reviewed for proper cement placement and isolation effectiveness. This review must be documented in the well file.